

National Exams May 2002

98-Agric-A1, Applied Plant, Animal or Human Physiology

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of the assumptions made.
2. **This is an OPEN BOOK EXAM. Any non communicating calculator is allowed.**
3. Any seven questions constitute a complete paper. Only the first seven questions as they appear in your answer book will be marked.
4. All questions are of equal value.

98-Agric-A1

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1. Describe the factors that influence the rate of loss of water from a plant canopy. Where appropriate, include equations.
2. What are the essential nutrients for plant growth?
3. Describe the mechanism by which chlorophyll absorbs and converts light into useable energy.
4. What is an action spectrum?
5. How much energy is there in a photon of 425 nm light? (Planck's constant = 6.62×10^{-34} J s photon⁻¹; speed of light = 3×10^8 m s⁻¹)
6. Describe the mechanism of gas exchange in plant leaves. How is this effected by water availability?
7. The following reactions are an integral part of photosynthesis:

$\text{H}_2\text{O} \rightarrow 2\text{H}^+ + 2\text{e}^- + \frac{1}{2} \text{O}_2$	$E_m = -320 \text{ mV}$
<u>$\text{NADP}^+ + 2\text{H}^+ + 2\text{e}^- \rightarrow \text{NADPH} + \text{H}^+$</u>	$E_m = +820 \text{ mV}$

$$\text{H}_2\text{O} + \text{NADP}^+ \rightarrow \text{NADPH} + \text{H}^+ + \frac{1}{2} \text{O}_2$$

What is the Gibbs free energy of the reaction ($F = 96.5 \text{ kC/mole}$)? Does the reaction proceed spontaneously?
8. How is light energy converted into ATP in the chloroplast?
9. What are the primary substrate of carbon dioxide fixation in the chloroplast? What is the enzyme involved in carboxylation?
10. How do plants respond to water deficit? What is the primary hormone involved in water stress? What is water potential?